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Moods and Their Relevance to Systems Usage Models within Organizations: An Extended Framework

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Abstract

Traditionally, information systems (IS) usage models have examined user behavior within a cognitive framework, that is, these models suggest that a user's cognition influences his/her IS usage behavior. Research over the past three decades has shown that mood, one's global feeling state at a given time, can significantly impact a person's cognitive processes. Mood effects on cognition are particularly relevant to organizational settings. Because moods are pervasive, they provide a stable context for cognitive processes that influence behavior at work; therefore, the inclusion of mood in individual IS usage models that support organizational tasks is both relevant and necessary. Because positive mood can enhance performance under certain circumstances, mood management is also relevant to IS usage models. Thus, we highlight how moods can be managed via IS and propose a model that takes into account users' moods at the time they work with a system. This model provides an extended framework for incorporating relevant mood literature into current IS usage behavioral models. With this model, researchers can examine certain aspects of the model (such as how IS design can influence user feeling states or how users' moods can impact their behavior), or conduct more comprehensive research using the entire model. This model can contribute to theory by providing a more complete picture of user behavior, and contribute to practice by helping mangers plan for desired outcomes.

Keywords: Mood, Cognition, Usage, Acceptance

Moods and Their Relevance to Cognitive IS Usage Models within Organizations

Introduction

Traditional Human Computer Interaction (HCI) research that focuses on individual information systems (IS) usage models has approached the acceptance (Davis et al., 1989; Yu-Hui et al., 2007) and utilization (Benbasat et al., 1991; Benbasat et al., 1999) of IS predominantly through the exploration of how IS design impacts cognitive processes, which in turn influence behavior. At the same time, research over the past three decades has shown that one's affect, or global feeling state, can significantly impact his/her cognitive processes. Therefore, including users' affect in cognitive behavioral models can provide a more complete picture of behavior. The role of affect in IS usage behavior literature has been acknowledged by researchers (Lee et al., 2003). However, the primary focus of IS research has been on attitudes, which are distinctly different from affect (Lazarus, 1991). Attitude refers to one's feeling towards an object. This is different from affect, which refers to one's feeling state at a given moment (George, 1989; George et al., 1996). In the IS context, attitude refers to how people *feel about* a system, while affect refers to how people *feel at the moment* they work with a system.

While a person's attitude towards a technology is important in understanding user behavior, the psychology literature provides compelling evidence that a person's feeling state is highly relevant to IS usage behaviors as well. Affect provides people with a context in which they experience their thoughts and behavior (Forgas et al., 2001). According to research examining the cognitive context for rational decision making (e.g.,

Damasio, 1994; Muramatsu and Hanoch 2005), affect plays a key role in our rational choices (Hanoch, 2002; Muramatsu et al., 2005). Thus, affect is likely to influence rational decisions, such as whether we choose to use an IS, and if so, whether we choose to use it fully.

In addition to the psychology literature, IS studies also provide support for the need to include a user's affect in IS research (Sun and Zhang, 2006; Zhang and Li, 2004, 2005, 2007). For example, Zhang and Li (2004, 2005, 2007) have shown that the perceived affective quality of an IS artifact (i.e., an artifact's ability to change one's feeling state) has an impact on users' intentions to use the artifact. A recent study (Djamasbi et al., 2010) shows the effects of feeling states on user behavior more directly. Rather than examining the impact of the affective quality of an IS artifact on acceptance behavior (Zhang et al., 2004, 2005, 2007), this study examined the effects of users' positive affect on behavior. The results from this study suggest that acceptance behavior is significantly influenced by a user's mild positive affect; people who were induced with such a positive state showed a significantly different acceptance behavior than those whose feeling states were not manipulated. Moreover, this study shows that the effects of positive affect on behavior were due to changes in cognition, and not due to simple response bias (i.e., a halo effect). These results show the importance of including affect in IS usage models.

Including affect in IS usage models gives rise to two other relevant research questions: If affect can predict IS usage behavior, can affect management help improve IS usage outcomes? If so, can affect be managed via specialized IS? Previous IS studies suggest that these research questions can also lead to a productive line of research for IS that supports organizational tasks (Djamasbi, 2007; Djamasbi et al., 2008c). For example,

there is evidence that users experiencing more positive affect increase their effort and enhance their performance (Djamasbi et al., 2008c). Additionally, there is evidence that affect can be managed via IS that either reduce negative feelings or increase positive ones. Negative feelings (e.g., frustration) encountered through interaction with IS can be successfully mitigated through specialized applications that provide emotional support (e.g., give users a place to complain about the system) (Picard et al., 2002). Furthermore, positive feelings can be increased by using systems that train and help users manage their affect (McCraty et al., 2006). Although these previous studies have alluded to the success of managing affect through IS, this work has not been fully developed and explored within IS individual usage models.

To address this need, we propose a conceptual usage model that includes affect and its management. First, we establish the background context of affect by providing a brief review of the affect literature that explains several constructs describing different feeling states. Next, we explain that *mood,* a type of affect, is particularly relevant to IS usage behavior within organizations and therefore is included in our conceptual model. We then highlight three key research questions and their related propositions. Finally, we discuss suggested methods of testing the proposed model and our conclusions.

Affect

Affect is an umbrella term for explaining one's feeling state or how one feels at a given moment. Thus affect describes a broad range of feelings, such as *moods* and *emotions*. Moods are "free-floating or objectless" affective constructs; they are not tied to a specific event, situation or behavior (Forgas, 1991; Fredrickson, 2003; Lazarus, 1991; Moore et al., 1990). They are less intense, yet more enduring than emotions (Fredrickson, 2003).

Moods refer to an individual's affective experience (i.e., how an individual feels when engaged in everyday activities such as work) (George, 1989; George et al., 1996). Because moods are objectless, they do not demand attention, and do not disrupt thought processes (Isen et al., 2003; Russell, 2003). Thus, they provide the affective context for an individual's ongoing activities (Clark et al., 1982; Isen, 2003; Isen et al., 2003). In other words, moods are not necessarily a product of reflection or cognitive analysis, but simply describe how people feel. For example, an individual's mood when at work captures how the individual feels *at* work, not necessarily how the individual feels *about* work. This distinction is an important one since the latter involves explicit cognitive evaluation (George et al., 1996).

While moods refer to the larger background of life, emotions refer to "an immediate piece of business, a specific and relatively narrow goal in an adaptation encounter with the environment" (Lazarus, 1991, p. 49). Unlike moods, emotions are short-lived, strong reactions which have both a specific cause (as in a provocative act) and a target (as in the target of anger). Moods and emotions have also been described through a two dimensional construct called *core affect* (Russell, 2003), which defines affective states along the continuums of valence (pleasure, displeasure) and intensity (activation, deactivation). Core affect can be objectless (i.e., is not directed towards anything or anyone) or it can become directed towards an object. Mild objectless core affect refers to those background feelings that do not disrupt cognition. Intense core affect, however, can interrupt one's cognitive processes. Thus, mood can be described as mild objectless prolonged core affect, and emotion as more intense and less enduring core affect directed toward an object. Both affective states (moods and emotions) can be influenced by

external causes, such as the *affective quality* of a stimulus. The affective quality of a stimulus is the capacity it has to change an individual's core affect (Russell, 2003). The affective constructs discussed above are summarized in Table 1.

Table 1: Constructs describing feeling states and their definitions from affect literature

Construct	Definition
Affect	A general term to describe a broad range of feeling states such as moods and emotions (Forgas et al., 2001)
Mood	An individual's mild, enduring, and objectless affective state (Fredrickson, 2003; Isen et al., 2003; Lazarus, 1991).
Emotion	An individual's intense, short lived affective state with a specific target and cause (i.e., anger towards your enemy) (Fredrickson, 2003; Lazarus, 1991).
Core affect	A two dimensional construct defining an individual's affective states along the continuums of valence and intensity. Core affect can be influenced by the *affective quality* of a stimulus (Russell, 2003).

Moods and Their Relevance to Systems Usage Models within Organizations

As discussed earlier, moods refer to mild pervasive affective states that do not have a specific cause or a specific target. Because moods are a stable and enduring affective framework in which cognitive processes occur, their effects become particularly relevant and important within an organizational context (Forgas et al., 2001). Thus, we include mood in our proposed framework for IS usage models in organizations. In particular, including mood in usage models may help to predict outcomes in situations in which traditional IS models cannot fully account for user behavior (e.g., Djamasbi et al., 2010; Keil et al., 1995; McCoy et al., 2007).

In the following sections we discuss the global categories of mood, how they are manipulated and measured, and how they influence cognition and behavior.

Specific versus General Mood Categories: Although moods can be defined as specific affective states (e.g., sadness, fear, happiness), they are often grouped into more general or global categories such as positive, negative, and neutral (Clark et al., 1982; Osgood et al., 1955; Schwartz et al., 1988). For example, PANAS (Watson et al., 1988) measures one's global mood by capturing 10 specific positive and 10 specific negative moods (see Appendix).

The mood literature suggests that positive mood exhibits more consistent effects than negative mood (Moore and Isen, 1990). For example, some studies have shown that only positive mood can increase the recall of mood-congruent information (Isen, 1970; Mischel, Ebbeson, and Zeiss, 1976, cited in Moore and Isen, 1990, p.13). However, other studies have shown that both positive and negative moods can increase the recall of mood-congruent information (Teasdale and Fogarty, 1979, cited in Moore and Isen, 1990, p. 13). While positive moods are consistently found to increase the recall of mood-congruent information, findings regarding negative moods are not so consistent. These results suggest that the effects of negative moods are more complex than those of positive moods (Moore and Isen, 1990). This difference, as we discuss in the next section, has been attributed to differences in theoretical foundations of the two moods. In particular, the complex behavioral consequences of negative mood suggests that negative mood may not be as homogenous as positive mood (Isen, 1984). For example, anger and sadness

tend to have different behavioral consequences, even though both are negative feeling states:

> "Nashby and Yando (1982) reported that anger (but not sadness) at the time of encoding (but not retrieval) facilitated the later recall of negative material. These findings indicate that the cognitive effects of anger are different from those of sadness. But they, and the data showing that anger (and sadness) impairs the recall of positive material, suggest that anger can reasonably be considered negative affect, nonetheless" (Isen, 1984, p. 202).

While the behavioral consequences of a specific positive mood tend to generalize to behavioral consequences of other specific positive moods, this may not be the case for specific negative moods. This is an important complexity to consider when conducting research involving negative moods.

Although specific feeling states can be grouped into opposite categories of positive and negative, there is evidence that these categories do not necessarily form a single affect continuum with positive affect at one end and negative affect at the other end (Isen, 1984, Larsen et al., 2003). If that were the case, we would experience only positive or negative affect at any given moment, but never both simultaneously. There is, however, evidence that both affective states can exist at once (Isen, 1984), such as when we experience pleasure and displeasure at the same time:

> "Reflecting on our own experience reminds us that opposite emotions such as happiness and sadness or confidence and fear sometimes seem to occur simultaneously, as for example at events such as weddings, or when embarking on a new venture … If opposite feeling states are reported simultaneously, it is also likely that they may exist simultaneously. This would not be possible if happiness and sadness, confidence and anxiety, and so forth, were in each case opposite ends of a single continuum" (Isen, 1984, p. 202).

The coexistence of positive and negative affect at the same time indicates that the two affective states are independent of each other and that they form distinct feeling states (Isen, 1984). We explain in the next section that in addition to forming distinct categories, positive and negative affect also have different theoretical foundations.

Positive versus Negative Mood: Both positive and negative moods can have a significant impact on cognitive processes (i.e., judgment, evaluations, decision-making, and behavior) (Isen, 1984); however, they have different theoretical foundations (Frederickson, 2003, Isen, 2008). Isen (1984) posits that as distinct feeling states, positive and negative affect have distinct behavioral consequences that are independent of each other:

> "Just as reward and punishment are no longer conceived to have symmetrical effects, so happiness and sadness may also come to be recognized as having different kinds of effects" (p. 202).

Supporting this point of view, research shows that positive and negative mood do not exhibit a symmetrical impact on organizing the cognitive content in one's memory. While studies show that positive mood can act as a reliable organizational cue for retrieving information learned during an experimental session, the same is not true for negative mood. This difference in behavioral effects of positive and negative moods suggests that the network of positive cognitive material may be more interconnected than the network of negative cognitive material in one's memory (Isen, 1984). Furthermore, as stated previously, positive moods (e.g., joy, happiness, pleasantness) may be more

homogeneous than negative moods (e.g., sadness, anger, unpleasantness) (Isen, 1984). Thus, both explanations indicate that positive and negative moods have different theoretical underpinnings.

The difference in the theoretical foundations of positive and negative affect can also be explained through the "specific action tendencies" model of behavior (Fredrickson, 2003, p. 165). According to this model, negative affect urges people to take an action chosen from a set of specific behavioral options. The action invoked by negative affect is not always the same, but it is always specific. For example, fear usually creates an urge to escape, and anger prompts an urge to attack (Fredrickson, 2003). While the action tendencies for negative affect tend to be specific, those action tendencies specified for positive mood are too vague to qualify as being specific. For example, escape specified for fear is specific, but inactivity specified for contentment is not (Fredrickson, 2003; Fredrickson et al., 1998). Consequently, positive and negative moods do not fit the same theoretical mold (Fredrickson, 2003). Investigating the behavioral consequences of positive and negative moods can, therefore, be done independently, without the need to understand one in the context of the other (Isen, 2003; Isen, 2008).

Mood Manipulations: Moods can be influenced by external causes, such as the *affective quality* of a stimulus, which is the capacity of a stimulus to change an individual's mood (Russell, 2003). For example, moods have been shown to be successfully manipulated or changed in experimental settings by showing a short clip of a movie (Isen et al., 1987), giving a small gift (Isen et al., 2005), providing performance feedback (Isen et al.,

1991b), and allowing a reasonable time limit for completing a complex task (Djamasbi et al., 2008c).

Moods can also be influenced in organizational settings by simple things, such as receiving a gift of chocolate (Estrada et al., 1997) or having a pleasant physical work environment (Baron et al., 1992; Isen et al., 1991a). However, one of the most effective ways to manage employees' moods in an organization is to help them find meaning in their daily work (Fredrickson, 2003; Pratt et al., 2003). For example, managers can influence employees' moods by facilitating experiences that foster social connections, achievement, involvement, and significance (Dutton et al., 2003; Folkman, 1997; Folkman et al., 2000; Fredrickson, 2003; Pratt et al., 2003; Ryff et al., 1998; Wrzesniewski, 2003). Recent studies provide evidence that moods can also be influenced with the use of specialized software. These systems and their role in individual IS usage models are discussed in a later section of this paper.

Mood Measurements: When studying mood, an important factor is its measurement. The most common way to capture this construct is through self-report measures, which often capture participants' moods by requiring them to rate how certain words best describe their current feeling state (e.g., Elsbach et al., 1999; Russell, 2003; Watson et al., 1988). These surveys can be used to measure positive or negative moods separately (e.g., Djamasbi et al., 2009) or can be combined to create an overall mood score (Djamasbi et al., 2008a; Elsbach et al., 1999) (see Appendix for an example of such a self-report survey). While both moods can coexist, the more salient mood (e.g., positive or negative) has the most impact on cognition and behavior (Bower, 1991; Ellis et al., 1988).

In addition to self-report surveys, moods can also be captured through the evaluation of neutral stimuli. For example, studies show that participants whose moods were positively manipulated rated the pleasantness of neutral stimuli (such as unfamiliar words or pictures of scenes with neutral affective tones) more positively than those whose moods were not manipulated (Isen et al., 1985; Isen et al., 1982).

Recent studies show that moods can also be captured through the analysis of physiological measures, such a user's heart rate variability (HRV) spectrum (McCraty et al., 2006). Because the subsystems in our body are coordinated with each other, one's psychological state is detectable through one's physiological state (McCraty et al., 2006). For example, positive and negative moods are evident by the patterns of our heart rhythm as shown in Figure 1.

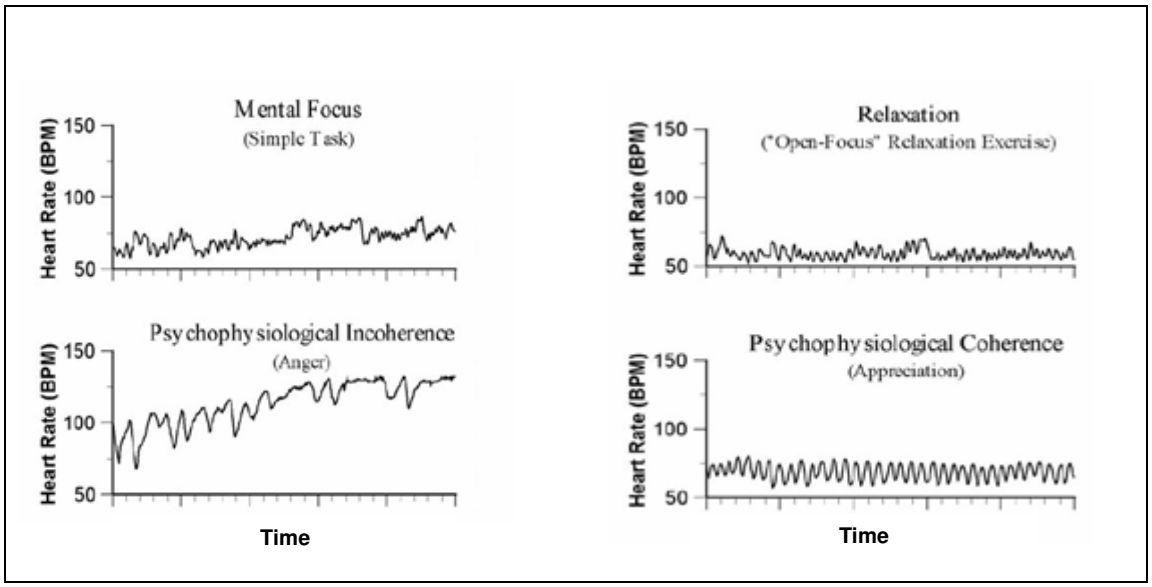

Figure 1: Heart rhythm patterns during different psychophysiological modes (McCraty et al., 2006, p. 13)

Mood Effects on Cognitive Content, Structure, and Processing Strategy: Mood has a significant impact on cognition and its ensuing behavior, according to the established

mood literature (Isen, 2008). Over the past two decades, there have been significant advances in mood research in psychology and neuropsychology (Ashby et al., 1999; Damasio, 1994; Isen, 2008). These bodies of research reveal that moods influence how people's thoughts are structured and retrieved. In turn, the structure and accessibility of our thoughts influence what ideas come to mind most easily, and thus help shape our decisions (Isen, 2008). Mood acts as an effective retrieval cue to prompt mood-congruent cognitive material in our minds. Positive moods prompt positive thoughts and memories, and negative moods cue negative thoughts and memories. Hence, individuals in a positive mood have access to a network of positive material in their cognitive system, and those in a negative mood have access to a network of negative material (Forgas, 2002; Isen, 2008). Cognitive content is important in rational behavior because what comes to mind first or most easily is shown to affect our judgments and evaluations (Tversky et al., 1973).

Mood can also impact our rational behavior by influencing how we combine new information (e.g., a newly formed judgment or evaluation) with our existing thoughts, which are clustered in groups, or "chunks," in our memory (Isen, 2008). Making sound judgments often relies on the ability to understand different aspects of a situation at hand (external stimuli) and the ability to recognize how our experience (internal data in our memory) can be applied to the situation. In other words, sound judgments often require the ability to discern different aspect of stimuli and the ability to effectively combine the external (different aspects of stimuli) and the internal (our thoughts and ideas) information. Mood can affect how we perceive different dimensions of stimuli and influence our ability to recognize possibilities for combining this external information

with our internal chunks of thoughts (Isen, 2008). Mood also affects our cognitive structure, or how our thoughts are grouped together. This, in turn, impacts the possibilities for combining the new and old information in our memory. Thus, mood can affect how effectively the new information is absorbed into our existing schemas by influencing our ability to perceive possible matches between the new piece of information and the existing chunks of perceptions in our memory, as well as by influencing how the existing chunks of perceptions are organized to form a unit (Isen, 2008).

Mood can also impact our behavior by influencing our information processing style (how we go about making decisions). Effective decision-making requires employing an information processing strategy that is suitable to the decision environment, and thus yields satisfactory results given the circumstances at hand (Djamasbi et al., 2008c; Payne et al., 1993). For example, some decisions and their given circumstances may require elaborate systematic information processing strategies while others may benefit from less effortful heuristic strategies. Literature provides compelling evidence that whether we engage in an elaborate or less elaborate strategy to process information is significantly influenced by our mood (Forgas, 2002; Isen, 2008).

Mood Effects and Task: According to affect theories, such as the Affect Infusion Model (AIM) and Positive Mood Theory (Forgas, 2002; Isen, 2008), task characteristics play a great role in whether mood effects on cognition result in observable behavioral changes (Forgas, 2002; Isen, 1993; Isen, 1999). Because mood influences cognition, the more cognitive processing a task requires the more likely it is for the behavioral effects of

mood to take place. Mood effects are often detected for tasks that are complex, unfamiliar, and/or uncertain (Forgas, 2002; Isen, 2008). For example, mood effects are shown to be significant for complex tasks such as diagnosing cancer (Estrada et al., 1997; Isen et al., 1991b), but not for simple routine tasks, such as finding matches for a string of letters in a line of text (Isen, 1993).

Mood Effects and Voluntary Use of Systems: Literature also suggests that mood may affect whether people voluntarily engage in a task. For example, people in a positive mood tend to prefer activities that maintain their positive mood and shy away from activities that may not be enjoyable (e.g., boring) or negatively affect their "good" mood (Isen, 1993). However, when people in a positive mood are asked explicitly to engage in such activities or it is explained to them that their participation is important, they will engage in the activity and perform as well as their control counterparts (Isen, 1993). People in negative moods, on the other hand, tend to voluntarily engage in tasks that are not enjoyable if they believe that such tasks will produce successful results. This is because people in a negative mood are motivated to change their moods and success can achieve this goal (Clark and Isen, 1982).

In summary, the above discussion shows that mood impacts behavior by influencing cognitive content, structure, and processing style (Forgas et al., 2001). Mood plays a significant role in shaping our judgments and evaluations and affects our cognitive processing style and flexibility in integrating new information (Forgas, 1995; Isen, 2008; Tversky et al., 1973). Mood effects on cognition and behavior are task dependent and our mood may influence whether we voluntarily engage in a task.

The Effects of Perceptions, Evaluations, and Cognitive Effort on IS Usage Behavior

Systems that are not successfully adopted often remain underutilized (Malhotra et al., 2004; Markus et al., 1994). Not surprisingly, a great number of IS studies have focused on understanding behavioral aspects of IS usage. These studies often focus on users' perceptions of a system and cognitive factors (such as ease of use, usefulness, etc.) that can influence those perceptions (e.g., Davis et al., 1989).

In addition to adoption, user behavior can also influence effective usage of systems that support organizational tasks (Djamasbi et al., 2008a). Because people have a limited cognitive capacity, they often use computers to reduce their cognitive effort (Benbasat et al., 1991; Benbasat et al., 1999). This point of view suggests that IS will help to make more efficient, but not necessarily better quality decisions (Benbasat et al., 1991; Benbasat et al., 1999). Consequently, many studies have focused on cognitive factors that can help improve involvement with a system and thus the quality of decisions made using an IS (Benbasat et al., 1991; Djamasbi et al., 2008c; Hess et al., 2006; Lim et al., 2005).

The above discussion shows that individual IS usage models are often built on a cognitive framework. These models examine the effect of cognitive factors on user behavior through objective measures of performance (e.g., Todd and Benbasat, 1992), through subjective self-report measures of perceptions or evaluations (e.g., Hess et al., 2006), or both. Todd and Benbasat (1992) proposed that cognitive effort influences the way people use IS, and they employed objective measures of performance to test their model. Hess et al. (2006) found that cognitive absorption and spontaneity influence a user's involvement

with an IS, and thus impact his/her computer-aided decision performance. Objective measures (e.g., decision quality) and self-report measures were both used to test this model (Hess et al. 2006). Similarly, the Technology Acceptance Model (TAM) and Task-Technology Fit (TTF) model examine usage behavior by investigating the influence of users' thoughts or evaluations (e.g., user perceptions and beliefs) on their behavior and/or intentions.

The Effects of Cognitive Content, Structure, and Processing Strategy on Perceptions, Evaluations, and Cognitive Effort

The IS usage models discussed in the previous section show that cognition has a significant impact on user behavior. In other words, a user's acceptance of a system can reliably be predicted by the user's evaluations and perceptions of a system, and a user's performance by his or her willingness to expend cognitive effort. In turn, a user's evaluations, perceptions, and cognitive effort, are influenced by his/her cognitive content, structure, and processing strategy (Isen, 2008). Our judgments and evaluations are influenced by the thoughts that are most readily accessible to us (Tversky et al., 1973). Whether we can access a thought or not depends on whether it is available in our memory (i.e., our cognitive content). How readily a thought is accessed depends on how thoughts are organized in our memory (i.e., cognitive structure) (Isen, 1984). Similarly, perceptions are influenced by cognitive content and structure. The content of our memory, as well as how it is organized, influences our ability to combine the external information with the pre-existing knowledge in our memory (Isen, 2008). This can affect our perception of the situation at hand (Isen, 2008). Our performance is influenced by our willingness to expend cognitive effort (Benbasat and Todd, 1999), which in turn is

influenced by our cognitive processing strategy (Isen, 2008). When we process information, the more elaborate the cognitive strategy we employ, the more willing we are to expend cognitive effort (Isen, 2008; Forgas, 2002).

In other words, cognitive content, structure, and processing style can affect our perceptions, evaluations, and cognitive effort. Because IS usage behavior is influenced by perceptions, evaluations, and cognitive effort, paying attention to factors that can affect cognitive content, structure, and processing style is likely to improve our understanding of user behavior.

Mood and Individual IS Usage Behavior

In the previous section, we explained that examining factors that can affect our cognitive content, structure, and processing style is likely to help researchers better understand IS usage behavior. In an earlier section, we discussed that mood can influence our cognitive content and structure as well as our information processing style (Isen, 2008). These two sections together provide the core for our proposed model and the argument that IS usage theories can benefit from the inclusion of mood in their models.

Three recent studies provide evidence for the validity of this argument (Djamasbi et al., 2010, Djamasbi, 2007). One of these studies shows that positive mood can influence a user's acceptance behavior through its effects on the user's cognition (Djamasbi et al., 2010). According to TAM, people tend to use a system that they find useful. Whether they find a system useful is strongly influenced by whether they find the system easy to use. Thus, TAM defines a relationship between the constructs ease of use, usefulness, and

intention to use. Using the mood theory proposed by Isen (1984), the above mentioned study shows that the relationships between the TAM constructs (ease of use, usefulness, and intention to use) were different for participants in the positive mood treatment when these relationships were compared to those of the control group. In the control group, as TAM asserts, ease of use predicted usefulness, and usefulness predicted intention to use. This was not the case in the positive mood treatment. Specifically, the results of this study show that intention to use a system that supports highly uncertain tasks was not predicted by the usefulness of the system for people who were induced with a positive mood. In other words, for those in a positive mood the relationship between usefulness and intension to use was not significant (Djamasbi et al., 2010). This finding is particularly important because usefulness is typically a strong predictor of intention to use a system. Thus, these results show that including mood in the model provided a more complete picture of user behavior.

The other two studies provide evidence that mood impacted users' performance by influencing their willingness to expend cognitive effort (Djamasbi, 2007). Users who were experiencing positive mood while working with a system that supported a moderately uncertain task used more of the information that was provided by their computers (Djamasbi, 2007, Djamasbi et al., 2008c). Users in the positive mood group also finished their assigned tasks faster than users in the control group (Djamasbi et al., 2008c). Additionally, people in a positive mood outperformed their control counterparts by making better computer-aided decisions (Djamasbi, 2007, Djamasbi et al., 2008c). These results provide further support for the argument that IS usage behavior is likely to be influenced by a user's mood.

Mood Management

The literature discussed previously suggests that a person's mood is likely to better explain his/her IS usage behavior supporting organizational tasks, and thus including it in such models is both relevant and necessary. Additionally, several recent studies provide evidence that positive mood can improve IS usage behavior in certain situations (Djamasbi, 2007; Djamasbi et al., 2008c). For example, positive mood improves users' cognitive effort when working with a system that supports uncertain tasks (Djamasbi, 2007). Similarly, users experiencing a more positive mood compared to their control counterparts use decision aids that support uncertain tasks both more effectively and efficiently (Djamasbi et al., 2008c). These studies suggest that under certain circumstances users can benefit from mood management (i.e., having positive mood as their dominant affective state). Mood management can be achieved by reducing negative mood (Isen and Baron, 1991), by increasing positive mood (Frederickson, 2003), or both.

While mood management has been researched in organizational contexts and through managerial interventions (Fredrickson, 2003; Wrzesniewski, 2003), little work has extended this research into the IS field. There is, however, preliminary evidence that IS can be used to help manage users' moods (Klein et al., 2002; McCraty et al., 2006; Picard, 2000; Picard et al., 2002). For example, a number of studies have argued and provided evidence that "when a computer creates frustration on the part of the user, it can relieve that frustration quickly and effectively by means of active emotion support" (Klein et al., 2002, p. 124). People treat their computers as if they are social actors (Reeves and Nass, 1996). Thus, computers that are designed to incorporate successful

strategies in supporting one's affect in social contexts are likely to help manage the mood of a user (Picard et al., 2002, Klein et al., 2002). According to social psychology, one such successful strategy is active listening (Raskin et al., 1995). Active listening can be defined as "providing sincere, non-judgmental feedback to an emotionally distressed individual, with a focus on providing feedback of the emotional content itself" (Klein et al., 2002, p. 122). Active listening shows a person that his or her affect has been successfully communicated and is accepted by the listener (e.g., sorry to hear you are experiencing difficulties) (Picard, 2002). This strategy has been shown to help users recover from negative affect (Klein et al., 2002).

In addition to reducing users' negative feelings that can arise when they interact with a system, physiological and medical research on cognitive coherence (discussed earlier) shows that IS can be used to induce positive moods (McCraty et al., 2006). Because the interactions among our body's subsystems are coordinated, one's psychological state can be influenced by one's physiological state, such as one's heart rate variability, which can be manipulated by techniques, such as controlling one's rhythm of breathing (McCraty et al., 2006). People can learn to increase their positive mood by learning to control their breathing pattern. Supporting this argument, studies show that people can be trained to sustain a positive affect by using specialized systems that monitor and provide information about their heart rate variability. For example, employees who suffered from hypertension were able to successfully reduce their negative affect (stress) and increase their positive affect (calm) when they learned to control their heart rate variability by using a specialized system that provided them with information about the pattern of their heart rate (McCraty et al., 2003b). Using a similar heart rhythm monitoring and feedback

system, correctional and police officers were able to reduce the effects of stress at work (McCraty et al., 2003a; McCraty et al., 1999).

The above discussed literature provides evidence that moods can be managed with IS. However, the effect of such systems on IS usage behavior, particularly for IS that support organizational tasks, is not fully tested. In the following section, we propose a model that can guide such future tests.

Proposed Model: Extended Individual IS Usage Model

As discussed earlier, traditional IS usage models show that cognition has a significant impact on user behavior (e.g., acceptance and performance) (Davis, 1989; Venkatesh et al., 2003; Todd et al., 1993; Todd et al., 1994). Because cognition is influenced by mood (Isen, 2008), mood has also been shown to influence a user's performance (Djamasbi, 2007; Djamasbi et al., 2009; Djamasbi et al., 2010; Djamasbi et al., 2008b). For this reason, we argue that mood should be included in IS usage models that have a cognitive framework.

To this end, we propose a conceptual model for individual use of IS that supports organizational tasks. Grounded in mood literature, this model (Figure 2) suggests that moods affect IS usage behavior through their impact on cognition. Because moods affect cognitive content, structure, and processing strategies, they are likely to influence a user's perceptions, evaluations, and cognitive effort, which in turn are shown to have an impact on the user's IS usage behavior. The effects of mood on perceptions, evaluations, and effort, however, are likely to be moderated by the task and the voluntariness of the

system. The model also suggests that mood effects on IS usage behavior can be manipulated by using software applications that can manage mood.

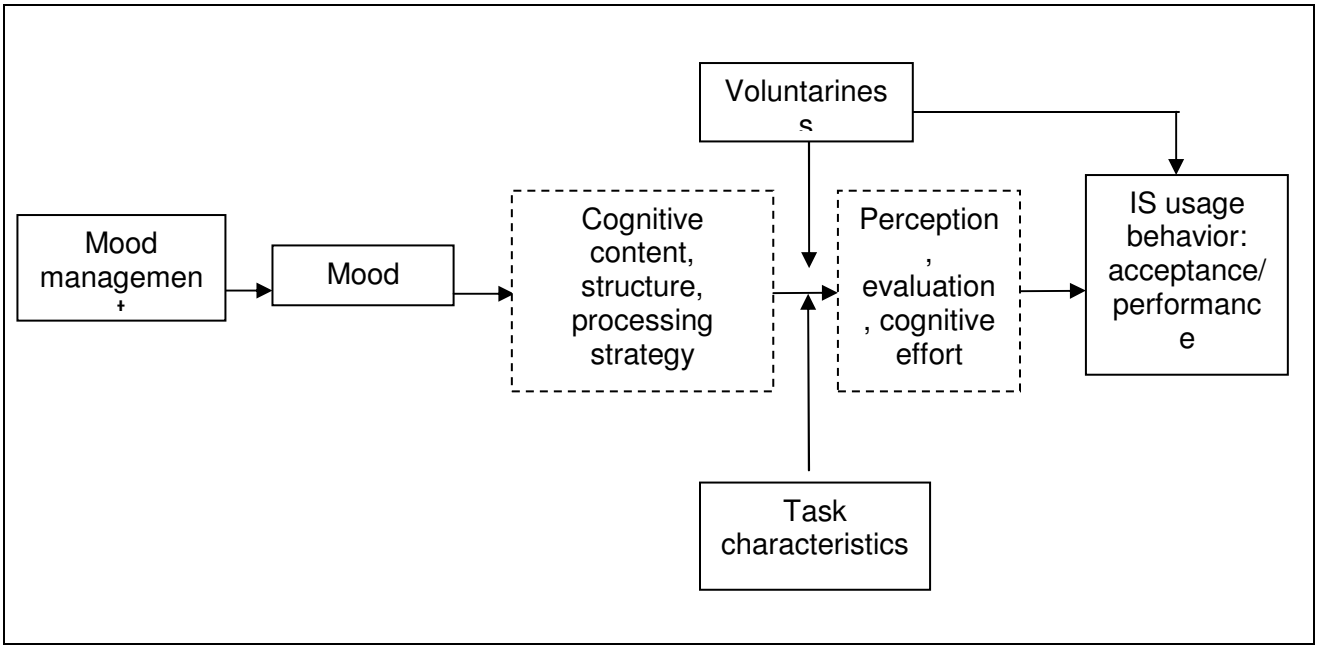

Figure 2: Proposed Conceptual Model (Including Mood in IS usage Research)

In the proposed model, task plays a central role. The affect literature suggests that the influence of an individual's mood on his/her behavior is task-dependent (Forgas, 2002; Isen, 1993). According to affect theories (e.g., Forgas, 1995; Isen, 2008), the influence of mood on cognition and behavior is more likely to take place if the task is complex and requires substantive cognitive processing. Consistent with these theories, the influence of mood on performance has been detected for complex tasks, such as in the previously mentioned example of cancer diagnosis (Estrada et al., 1997; Isen et al., 1991b), complex managerial decisions (Barsade et al., 2007; Djamasbi, 2007; Djamasbi et al., 2008b), and

foreign exchange trading (Au et al., 2003). Therefore, we propose that the influence of mood on a user's behavior depends on the task that is being supported (completed) by IS.

Based on our conceptual model, we highlight three key research questions and related propositions. In situations where a task is conducive to mood effects, it is crucial to understand how IS usage is influenced by a user's mood. Thus, the first research question focuses on understanding which mood type (e.g., positive or negative) is more likely to have an impact on user behavior. Whether using a system is voluntary or mandatory is likely to result in different IS usage behavior depending on a user's mood type. Thus, the second research question focuses on understanding behavior in regards to a user's mood type (positive or negative) and system usage options (voluntary or mandatory). Finally, evidence that positive mood can result in improved IS usage behavior suggests that facilitating positive mood can be desirable under certain circumstances. Thus, the last proposal is concerned with facilitating positive mood through specialized IS applications. In the following paragraphs, we discuss each of these research questions in detail.

Research Question 1: When task characteristics (i.e., complex, uncertain, and familiar) facilitate mood effects on individual IS usage behavior, which mood type (e.g., positive or negative) can best predict behavior in individual IS?

Positive mood facilitates creativity and innovation (Forgas, 1995; Isen, 2008). For example, people in a positive mood outperform their counterparts in tasks that call for an innovative solution (Isen, 2008; Isen et al., 1987). However, when the task does not call

for creativity, individuals in a positive mood will not exhibit better performance than those in a neutral mood (Isen, 1993).

Further, negative moods result in better performance when the task requires following a specific set of rules. For example, when individuals were given a detailed set of rules to solve a problem (considering multiple factors to decide whether a team should participate in a race), those in a negative mood were more likely to use the given set of rules and rely on the results of their structured decision protocol to make decisions (Elsbach et al., 1999). This behavior is explained by Affect Repair Theory (Clark et al., 1982), which argues that people are motivated to change their negative moods to positive moods. Structured decision protocols are designed to solve specific problems and thus their use is likely to lead to success. Because people in negative moods are motivated to change their mood, they are more likely to follow such protocols rather than using other methods (e.g., intuitive or creative methods) in order to "repair" their negative mood (Elsbach et al., 1999). Thus, we propose:

> Proposition 1: The type of mood (i.e., positive or negative) that best predicts individual IS usage behavior (e.g., performance) is likely to depend on the type of task conditions.

> Proposition 1a: Positive mood is likely to improve individual IS usage behavior (e.g., acceptance and performance) when the task conditions are more unstructured and require creative or innovative solutions.

Proposition 1b: Negative mood is likely to improve individual IS usage behavior (e.g., acceptance and performance) when the task conditions are more structured and require the use of specific guidelines.

Research Question 2: Can the voluntary use of a system affect mood and IS usage behavior?

The voluntary use of a system is defined as "the degree to which use of the innovation is perceived as being voluntary or of free will" (Moore et al., 1996, p. 195). Previous system acceptance research has found that whether using a system is voluntary or mandatory can impact a person's willingness to use it (Venkatesh et al. 2003). Mood literature shows that positive mood may affect voluntary engagement in a task when the subject perceives that the task may diminish the subject's positive mood. If the task is required, however, people in a positive mood behave no differently than their control counterparts (Isen, 1993). This suggests that the voluntariness of a system, in addition to affecting acceptance directly, may influence acceptance indirectly through mood effects.

Proposition 2: Voluntary use of a system is likely to moderate the behavioral effects of mood on IS usage.

As mentioned previously, literature suggests that mood may affect whether people voluntarily engage in an activity. Because those in a positive mood are more likely to prefer activities that maintain their positive mood and try to avoid activities that would negatively impact their good mood (Isen 1993), we propose that:

Proposition 2a: People in positive mood would be less likely to voluntarily use an IS when they believe that by doing so their positive mood would be reduced.

On the other hand, people in a positive mood are more likely to engage in an activity when explicitly asked to do so *and* when the importance of their participation is explained to them. Their performance under such situations is equal to that of their control counterparts (Isen, 1993). Thus, we propose that:

Proposition 2b: People in a positive mood would be more likely to voluntarily use an IS when they have been told why their use of the system is important or helpful compared to those in a positive mood who have not been told why their use of the system is important. For example, they have been told that by using the system they will contribute to solving an important problem.

People in negative moods, however, are more likely to engage in the voluntary use of a system, even if they think that doing so will not be particularly pleasant, *if* they believe that the results will be positive. This behavior is due to their desire to change their negative mood to positive; being successful at a task can help them reach this goal (Clark and Isen, 1982).

Proposition 2c: People in a negative mood would be more likely to voluntarily use an IS if they have been told that by doing so they would receive positive results compared to those in a negative mood who have not been told that use of the system would result in their receiving positive results.

Research Question 3: How can mood be managed through IS?

While positive and negative feelings can coexist, their behavioral consequence is determined by the mood that is more salient (Bower, 1991; Ellis et al., 1988). Thus, affect can be managed by facilitating conditions that make the positive mood more dominant, such as promoting situations that reduce negative mood (Isen et al., 1991a). Literature provides evidence that it is possible to reduce users' negative moods, caused by interacting with a system, when the system provides users with strategies that meet their emotional needs (Axelrod et al., 2006; Picard, 2000). For example, a software agent that recognizes users' frustration can reduce the users' negative moods through active listening techniques that give the users "room to vent" (Picard et al., 2002; Picard, 2000). For example, a computer may respond to a comment made by a frustrated user when trying to print a document (e.g., "sorry to hear you are experiencing difficulties") (Picard, 2002). These findings suggest that users' negative moods can be managed through the implementation of strategies, such as active listening, that have been proven successful in social contexts (Axelrod et al., 2006; Picard, 2000; Scheirer et al., 2002).

> Proposition 3: Specialized applications that implement emotion regulating strategies, such as active listening, are likely to reduce a person's negative moods.

Additionally, as discussed earlier, specialized applications can help users learn to regulate their physiological signs, such as their heart rate variability (HRV), and in turn help increase their positive moods. For example, the literature on cognitive coherence shows that through HRV monitoring and feedback processes, individuals can learn to change their mood (McCraty et al., 2006). After being trained to control their HRV, people often report that they experience fewer negative feelings at work (McCraty et al., 1999). Thus,

such monitoring through the inclusion of HRV feedback in IS that support organizational tasks is likely to help users manage their mood.

Figure 3 provides an example of a simple mood (HRV) monitoring application that can be used in conjunction with an existing system. The system presented in Figure 3 is a Computer Aided Dispatch (CAD) system to assist in emergency responses to 911 calls. A user of the CAD would use this system to aid in categorizing emergency calls and dispatching the correct response team (police, fire, or ambulance) to an incident. The independent mood monitoring application (gauge) can be seen in the bottom right-hand corner of Figure 3. The gauge indicator, pointing to the red area, shows that the current CAD user is not in the desired mild positive affective state that would allow him/her to make an effective decision. Knowing that s/he is not in the desired state to most effectively make decisions would help the user, previously trained in mood management, to realize the need to regulate his or her affective state, which would be indicated by the gauge moving into the green area. In this particular scenario, the application is not embedded in the CAD (it runs independently of CAD). Thus, the user is able to use the mood monitoring application with applications other than CAD that run on that system. Additionally the user is able to minimize the gauge to the task bar or completely ignore it if s/he so desires.

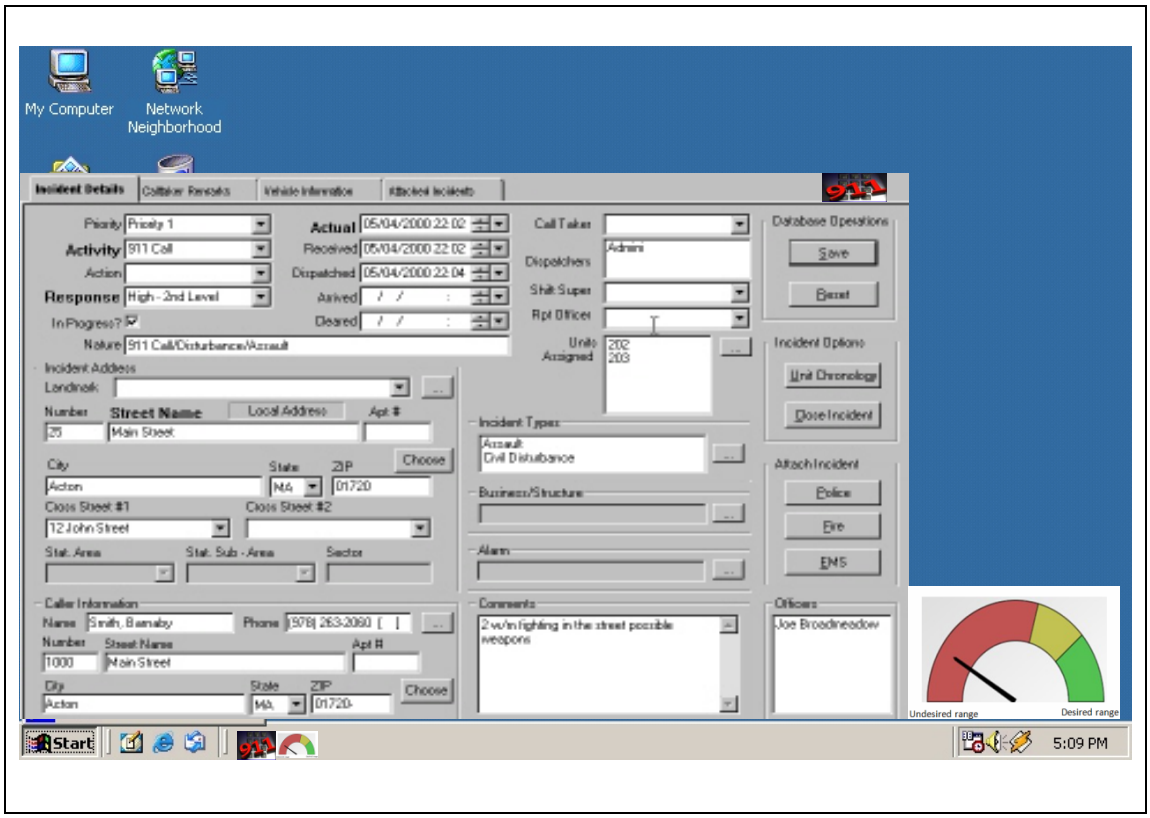

Figure 3: Example of Mood Monitoring Specialized Application in conjunction with CAD

Proposition 4: Specialized applications (either embedded or working in conjunction with another application) that monitor and display a person's HRV, in systems that support organizational tasks, are likely to help users manage their mood.

Suggested Methods

The proposed model in this study is concerned with individual use of systems that support organizational tasks (e.g., work related websites, decision support systems, productivity systems, etc.). Participants should be matched appropriately to the systems; they should be chosen from the pool of users who work with such systems, such as

students (if the system is used by students to compete their work) or employees (if the system is designed to help these employees with their tasks).

The nature of the task, as well as the voluntariness of the system, is likely to moderate the mood effects on IS usage behavior. Thus, these variables must be carefully accounted for in order to better understand the relationship between mood and behavior.

Users' mood can be measured through self-report surveys (see Appendix for an example of such surveys). Additionally, moods can be measured indirectly through evaluation of neutral stimuli (Isen et al., 1985; Isen et al., 1982) or through physiological measures such as users' HRV (Djamasbi et al., 2008c; McCraty et al., 2006).

Because positive and negative moods have different theoretical foundations, their behavioral consequences on IS usage can be studied separately (i.e., independent of each other). Researchers can design studies to examine the effects of positive or negative mood on IS usage behavior separately.

Two primary methods for investigating the model are lab experiments and field studies. Lab experiments can be used to begin investigating the effect of mood on behavior in a controlled environment. In particular, lab experiments provide the researcher greater control over variables (e.g., user's mood, task). In other words, the experimental setting allows the examination of mood effects on IS usage behavior in a theoretically sound way. It allows for the control of confounding variables, such as the political climate (Staw and Barsade, 1993).

Field studies, as a complement to controlled experiments, can extend the generalizability of lab findings. For example, the effect of mood on IS usage within an actual

organization allows for the replication of experimental studies in a real-world setting. Such settings can test whether mood effects on IS usage behavior are strong enough to persist within the presence of uncontrolled variables that often permeate organizations, such as the physical and political environment. These types of studies would not only test the feasibility of using such mood management devices within a real-world organizational setting, they would allow researchers to investigate the ethical questions that using such devices brings. For example, is it appropriate or even acceptable to allow managers to see a worker's mood status, or should it only be seen by the worker to assist in his/her job? In other words, is mood personal data?

Conclusion

HCI researchers, in an attempt to help increase IS acceptance and use, often focus on understanding individual usage behavior from a cognitive perspective. Rarely, however, have these models paid attention to users' moods, which, according to the neuroscience and mood literatures, have a significant impact on cognition. Including mood in such IS usage models can provide a more comprehensive understanding of a person's behavior. The model proposed in this paper provides a framework for incorporating relevant affect literature into current IS usage behavioral models. This will allow researchers to examine certain aspects of the model, such as how IS design can influence users' moods. They can also investigate how users' moods impact their behavior. Finally, researchers can conduct more comprehensive studies using the entire model.

The proposed framework has both theoretical and practical implications. Theoretically, it provides a model that can help predict behavior more fully. For example, traditional IS models, under some circumstances, cannot fully explain user behavior (e.g., Keil et al., 1995; McCoy et al., 2007). Some researchers argue that this is because traditional individual-based IS usage models do not pay attention to users' individual characteristics and attributes, which can have a significant impact on cognition (McCoy et al., 2005). Because positive mood is an important individual attribute providing the context for users' cognitive processes (Fredrickson, 2003; Isen, 2008), its inclusion in individual IS usage models can improve the understanding of user behavior, especially when the traditional models lack strong explanatory power.

In addition to its theoretical significance, understanding mood effects on IS usage behavior is of practical value. Employees' moods can be affected by factors within the control of a company, such as the work environment and/or organizational climate (e.g., Fredrickson, 2003; Küller et al., 2006; Pratt et al., 2003). Furthermore, new advances in technology suggests that employees' moods may be managed successfully via specialized IS applications. Such applications provide a practical method of mood management that can help to plan for utilizing desirable behavioral effects and/or avoiding unattractive consequences. In other words, because mood has an impact on user behavior, managers can use it to help create desired outcomes.

The proposed model stimulates three overarching research questions. First, the task-dependent nature of mood effects calls for scientific examination of task combinations that may be most conducive to mood effects. For example, using IS that support tasks dealing with many uncertain and complex factors (e.g., estimating the budget for a

project), is likely to reveal mood effects on usage behavior. However, using IS that support routine tasks with little or no uncertainty (e.g., payroll check run), may not show mood effects on usage behavior. Additionally, when a task is conducive to mood effects, a specific type of mood (positive, neutral, or negative) may result in a more desirable IS usage behavior. For example, a user working on a problem that requires creativity, (e.g., identifying several alternative solutions to a complex problem) is more likely to use IS more effectively, and consequently perform better, when in a positive mood than when in a negative or neutral mood.

For structured tasks, such as auditing or monitoring a safety system's dashboard, a person in a mild negative mood may be more effective at following the structured protocols designed to increase performance. This is not to say that one would want to evoke negative affect in a user, but simply harness an existing naturally occurring mild negative affect. Based on the mood repair theory, it is likely that people would naturally gravitate towards performing structured tasks when they are experiencing mild negative affect, because structured tasks can help improve one's affect. Because structured protocols are designed to increase the likelihood of success, following them is likely to help a person to feel "better." If this is true, companies may benefit from training users on what tasks they may be better at performing given their current affective state.

Second, when an individual has the option to use a system, his/her mood is likely to affect that decision. For example, people in a positive mood may shy away from using a system that they feel may negatively affect their "good" mood. Similarly, people in a negative mood may be more likely to use a system that they believe will enhance their performance, and thus help improve their mood.

Finally, IS can effectively manage mood in situations where positive mood results in desirable IS usage outcomes. For example, a system that recognizes user frustration and successfully responds to it (Picard, 2000) is likely to enhance the user's mood. Similarly, a system that provides mood-related feedback to the user, such as a visual or auditory display of their mood related physiological measures (e.g., heart rate variability), is likely to assist the user in managing his or her mood.

The measurement of mood is likely to be important for information systems research because mood is pervasive, influences our cognition, and reliably predicts behavior. This paper has provided a general model of mood that should be investigated by laboratory and field studies alike. If we understand mood more thoroughly, then we can take advantage of its desirable outcomes and avoid or mitigate its undesirable effects on IS usage behavior.

Appendix

Positive and Negative Affect Schedule (PANAS) (Watson, Clark, and Tellegen, 1988) a 5-point scale (1 = very slightly or not at all, 2 = a little, 3 = moderately, 4 = quite a bit, and 5 = extremely) to measure the extent to which the following 20 items describe an individual's feelings at the moment:

1. Interested
2. Distressed
3. Excited
4. Upset
5. Strong
6. Guilty
7. Scared
8. Hostile
9. Enthusiastic
10. Proud
11. Irritable
12. Alert
13. Ashamed
14. Inspired
15. Nervous
16. Determined
17. Attentive
18. Jittery
19. Active
20. Afraid

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